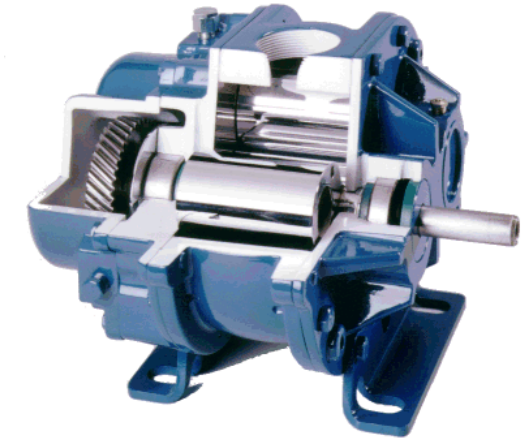

COMPETITOR PLUS™

Rotary Positive Blowers

COMPETITOR PLUS rotary blowers are designed to be interchangeable with equivalent sizes of Roots Universal RAI®, and many Sutorbilt® California Series B and F, and Legend™ Series L and P blowers. **COMPETITOR PLUS** models are rated up to 15 PSIG discharge pressure or 16" Hg dry vacuum.

In addition to interchangeability, M-D has improved on existing designs with the following superior features ordinarily found only on premium blowers:

Helical Gearing

COMPETITOR PLUS blowers are timed with hardened, precision helical gears, keyed to the rotor shafts, not taper fit spur gears offered by other manufacturers which have greater backlash, and can slip and lose timing. Helical gears are also quieter, reducing mechanical noise.

Stronger Bearings

COMPETITOR PLUS blowers include double row ball bearings at the gear end, stronger than single row ball bearings offered by other manufacturers. Drive shaft bearing is cylindrical roller type for additional strength against side loading from V-belt drives. As a result of this superior design, **COMPETITOR PLUS** blowers offer an average design bearing life of up to 50% greater than models offered by other manufacturers.

Rotors with Integral Shafts

COMPETITOR PLUS blowers include precision machined ductile iron rotors with large, integrally cast shafts, not press fit and/or pinned shafts offered by other manufacturers, which can loosen over time and cause rotor clash. All rotors are dynamically balanced for vibration-free rotation.

Positive End Clearances

End clearances are positively established at the blower gear end, eliminating the risk of shifting end clearances when installing or removing drive components. This also eliminates the need for those special fork and saddle tools required by other brands to reset end clearances.

Polished Sealing Surfaces

All shaft surfaces in contact with sealing members are polished to reduce seal wear and risk of leakage.

Individually Tested

Every **COMPETITOR PLUS** blower is factory tested to assure you of the highest quality. While some manufacturers perform only sample testing, M-D goes the distance to insure that your blower meets our rigid ISO 9001 registered quality standards.

ISO 9001 Registration

COMPETITOR PLUS blowers are manufactured under M-D's ISO 9001 registered quality assurance program, the first American manufacturer of rotary blowers to gain such international recognition.

Warranty

Every **COMPETITOR PLUS** blower is backed by M-D's limited warranty for a period of 18 months after installation or 2 years after original blower shipment, whichever occurs first.

Versatility

COMPETITOR PLUS blowers can be field converted from horizontal to vertical flow, or vice versa, without any special tools or additional components.

Metric Availability

All **COMPETITOR PLUS** blowers are available with metric drive shaft and process connections.

Worldwide Sales and Service

With sales offices and service facilities located on six continents, you can be assured of availability and service for your **COMPETITOR PLUS** blowers.

Material Specifications:

Housing: Cast iron

End Plates: Cast iron

End Cover: Cast iron

Rotors: Ductile iron

Shafts: Ductile iron cast integrally with rotors

Bearings: Gear end - Double row ball, both rotors
Drive end - Cylindrical roller on drive rotor
Single row ball on driven rotor

Drive Shaft: Ductile iron, cast integrally with drive rotor

Gears: Heat treated alloy steel, helical cut

Seals: Lip seals on rotor shafts and drive shaft

Lubrication: Oil splash on gear end, grease on drive end

Model Size	Max. Press. PSI	Max. Vac. (in. Hg)	Nominal Min. RPM @ Max. Disch. Press.	Nominal Max. RPM @ Max. Disch. Press.	Displ. CFR
2002	12	16	2940	5275	.016
2004	7	14	1480	5275	.032
3003	12	15	2080	3600	.0616
3006	7	12	1150	3600	.102
4002	15	16	1820	3600	.061
4005	10	14	1300	3600	.121
4007	7	14	1000	3600	.160
5003	15	16	1900	2850	.132
5006	10	15	980	2850	.221
5009	7	14	700	2850	.323
6005	15	16	1240	2350	.246
6008	12	16	890	2350	.395
6015	6	12	600	2350	.740

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www.mdpneumatics.com

Performance

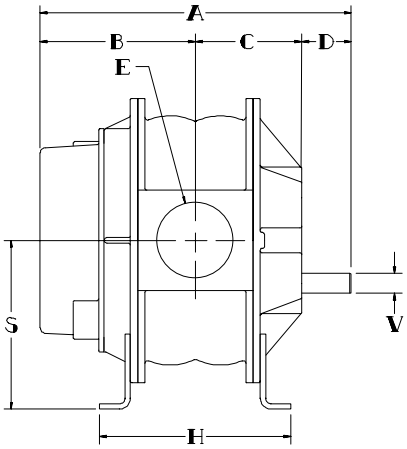
Pressure performance is based on inlet conditions of 14.70 PSIA and 70° F.

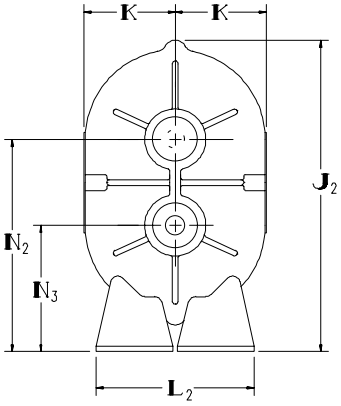
Vacuum performance is based on inlet temperature of 70° F and discharge pressure of 14.70 PSIA.

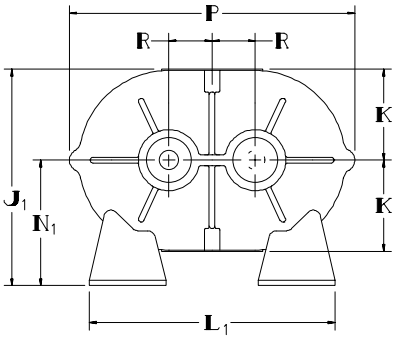
In conjunction with our program of continuous testing and upgrading, all specifications are subject to change without notice.

All data are approximate. Request a quotation for your specific application.

Blower	SPEED	2 PSIG		4 PSIG		6 PSIG		7 PSIG		10 PSIG		12 PSIG		15 PSIG		Max. Vacuum		
Model	(RPM)	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	" Hg	CFM	BHP
2002	1170	7	0.3													6	3	0.3
	3600	46	0.8	41	1.3	38	1.8	36	2.1	32	2.8	29	3.3			14	28	2.1
	5275	73	1.2	68	1.9	64	2.7	63	3.1	59	4.2	56	4.9			16	51	3.4
2004	1170	19	0.4	12	0.8											6	13	0.6
	3600	97	1.3	89	2.3	83	3.3	81	3.8							14	69	3.8
	5275	150	1.9	143	3.4	137	4.9	134	5.6							14	122	5.5
3003	1170	49	0.8	39	1.4	31	2.1	28	2.4							10	27	1.7
	2700	143	1.9	133	3.3	126	4.8	122	5.5	114	7.7	109	9.1			14	107	5.4
	3600	198	2.5	188	4.5	181	6.4	178	7.4	169	10	164	12			15	158	7.7
3006	1170	86	1.2	72	2.3	62	3.3	57	3.8							10	56	2.7
	2700	242	2.8	228	5.2	218	7.6	213	8.9							12	202	7.5
	3600	334	3.8	320	7.0	310	10	305	12							14	283	12
4002	880	34	0.6	26	1.1	19	1.6	17	1.8							10	16	1.3
	1760	87	1.3	79	2.2	73	3.1	70	3.6	63	5.0	59	5.9			14	57	3.5
	3600	198	2.6	190	4.5	184	6.4	181	7.4	174	10	170	12	164	15	16	159	8.2
4005	880	70	1.1	55	2.0	44	3.0	39	3.4							8	47	2.0
	1760	177	2.2	162	4.1	150	5.9	145	6.9	132	9.6					13	127	63
	3600	399	4.5	384	8.3	373	12	368	14	355	20					14	349	13
4007	880	93	1.4	74	2.6	59	3.9	52	4.5							8	63	2.6
	1760	234	2.8	214	5.3	199	7.7	193	8.9							12	176	7.6
	3600	527	5.7	508	11	493	16	486	18							14	472	18
5003	710	64	1.0	52	1.6	43	2.7	39	3.1							10	37	2.2
	1760	203	2.6	191	4.6	181	6.6	177	7.6	167	11	160	13	152	16	14	158	7.5
	2850	346	4.1	334	7.4	325	11	321	12	310	17	304	21	295	25	16	289	14
5006	710	108	1.6	87	3.0	71	4.3	65	5.0							10	62	3.6
	1760	340	3.9	319	7.3	303	11	297	12	278	17					14	263	12
	2850	581	6.4	560	12	544	17	537	20	519	28					15	496	21
5009	710	173	2.2	151	4.2	133	6.2	125	7.2							10	122	5.1
	1760	513	5.5	490	10	472	15	464	18							12	445	15
	2850	865	8.9	842	17	824	25	816	29							14	779	28
6005	710	129	1.8	110	3.3	95	4.9	89	5.6	72	7.9					12	73	4.8
	1760	387	4.5	368	8.3	354	12	347	14	330	20	160	23	307	29	16	300	16
	2350	532	6.0	513	11	499	16	492	19	476	26	304	31	452	38	16	445	21
6008	710	207	2.7	176	5.2	153	7.6	143	8.9	116	13					12	117	7.5
	1760	621	6.8	591	13	568	19	557	22	530	31	515	37			16	481	25
	2350	854	9.1	824	17	801	25	790	29	764	41	748	50			16	714	33
6015	710	387	4.9	330	9.5	286	14									8	300	9.3
	1760	1164	12	1107	23	1063	35									12	996	34
	2350	1601	16	1544	31	1500	46									12	1433	46







Dimensions

Model Size	A	B	C	D	E	H	J1	J2	K	L1	L2	N1	N2	N3	P	R	S	V
2002 2004	9.75 11.75	4.63 5.63	2.63 3.63	2.50	1" NPT 2" NPT	5.00 7.00	6.88	9.69	3.13	5.13	5.13	3.75	6.25	3.75	9.38	1.25	5.00	.625
3003 3006	12.19 14.56	5.94 7.13	3.75 4.94	2.50	2" NPT 2½" NPT	7.63 10.00	8.94	12.81	3.94	7.25	7.25	5.00	8.50	3.75	12.19	1.75	6.75	.750
4002 4005 4007	12.56 15.31 17.06	5.88 7.25 8.13	3.69 5.06 5.94	3.00	1½" NPT 2½" NPT 3" NPT	7.25 10.00 11.75	10.63	15.13	4.38	8.00	8.00	6.25	10.25	5.00	13.69	2.00	8.25	.875
5003 5006 5009	14.88 17.50 20.50	7.00 8.31 9.81	4.50 5.81 7.31	3.38	2½" NPT 4" NPT 4" NPT	8.38 11.00 14.00	12.13	17.38	5.38	10.50	10.50	6.75	11.25	6.25	17.19	2.50	8.75	1.125
6005 6008 6015	18.38 21.38 28.38	9.06 10.56 14.06	5.63 7.13 10.63	3.69	3" NPT 5" NPT 6" FLG	10.13 13.13 20.18	15.06	21.69	6.25	17.00	11.00	8.75	14.75	8.75	19.81	3.00	11.75	1.375

Values shown are approximate and should not be used for construction.
Certified drawings are available through your local M-D Sales Professional.

Your Local M-D Sales Professional is:

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ISO 9001 REGISTERED M-D PNEUMATICS DIVISION TUTHILL CORPORATION INTERNATIONAL QUALITY STANDARD

Tuthill Pneumatics

COMPETITOR+ PLUS™

Rotary Positive Displacement Air Blower

Models

2002	3003	4002	5003	6005
2004	3006	4005	5006	6008
		4007	5009	6015

INSTALLATION
OPERATION
MAINTENANCE
REPAIR
MANUAL

WARNING

DO NOT OPERATE BEFORE READING MANUAL.

REGISTERED PNEUMATICS GROUP ISO 9001 TUTHILL CORPORATION INTERNATIONAL QUALITY STANDARD

01/2001

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www.mdpneumatics.com

SAFETY INSTRUCTIONS

1. Do not operate before reading the enclosed instruction manual.
2. Use adequate protection, warning and safety equipment necessary to protect against hazards involved in installation and operation of this equipment.

SAFETY WARNING

- Keep hands and clothing away from rotating machinery, inlet and discharge openings.
- Blower and drive mounting bolts must be secured.
- Drive belts and coupling guards must be in place.
- Noise level may require ear protection.
- Blower heat can cause burns if touched.

TUTHILL PNEUMATICS GROUP Springfield, MO USA

NOTICE

The above safety instruction tags were attached to your unit prior to shipment. Do not remove, paint over or obscure in any manner.

Failure to heed these warnings could result in serious bodily injury to the personnel operating and maintaining this equipment.

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SAFETY PRECAUTIONS

For equipment covered specifically or indirectly in this instruction book, it is important that all personnel observe safety precautions to minimize the chances of injury. Among many considerations, the following should particularly be noted:

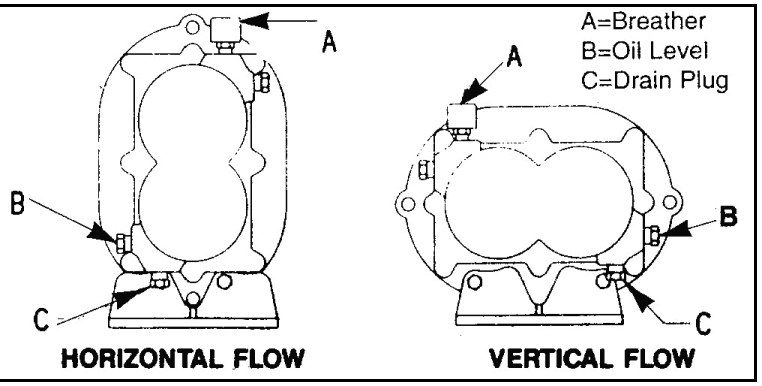
- Blower casing and associated piping or accessories may become hot enough to cause major skin burns on contact.
- Internal and external rotating parts of the blower and driving equipment can produce serious physical injuries. Do not reach into any opening in the blower while it is operating, or while subject to accidental starting. Cover external moving parts with adequate guards.
- Disconnect power before doing any work, and avoid bypassing or rendering inoperative any safety or protective devices.
- If blower is operated with piping disconnected, place a strong, coarse screen over the inlet and avoid standing in discharge air stream.
- Avoid extended exposure in close proximity to machinery with high intensity noise levels.
- Use proper care and good procedures in handling, lifting, installing, operating, and maintaining the equipment.
- Other potential hazards to safety may also be associated with operation of this equipment. All personnel working in or passing through the area should be warned by signs and trained to exercise adequate general safety precautions.
- Hearing protection may be required depending on silencing capabilities.

CAUTION!

Most COMPETITOR PLUS™ blowers are shipped from the factory in a left hand drive, vertical flow configuration.

If drive shaft location is changed, the oil level plug and breather must be relocated to proper positions, as shown to the right.

Failure to change plug location will result in blower failure and void the product warranty.



INTRODUCTION

CONGRATULATIONS on your purchase of a new Tuthill Pneumatics COMPETITOR PLUS™ Rotary Positive Displacement Blower from Tuthill Pneumatics Group. Please examine the blower for shipping damage, and if any are found, report it immediately to the carrier. If the blower is to be installed at a later date make sure it is stored in a clean, dry location and rotated regularly. Make sure covers are kept on all openings. If blower is stored outdoors be sure to protect it from weather and corrosion.

COMPETITOR PLUS™ blowers are built to exacting standards and if properly installed and maintained will provide many years of reliable service. We urge you to take time to read and follow every step of these instructions when installing and maintaining your blower. We have tried to make these instructions as straightforward as possible. We realize getting any new piece of equipment up and running in as little time as possible is imperative to production.

WARNING: **Serious injury can result from operating or repairing this machine without first reading the service manual and taking adequate safety precautions.**

IMPORTANT: Record the blower model and serial numbers of your machine in the OPERATING DATA form below. You will save time and expense by including this reference identification on any replacement part orders, or if you require service or application assistance.

OPERATING DATA

It will be to the user's advantage to have the requested data filled in and available in the event a problem should develop in the booster or the system. This information is also helpful when ordering spare parts.

Model No. _____

Serial No. _____
(Recorded from nameplate on unit)

Startup Date _____

Blower RPM _____

Blower Sheave Diameter _____

Motor Sheave Diameter _____

Motor RPM _____ HP _____

V-Belt Size _____ Length _____

Type of Lubrication:
Oil (Gear Case) _____

Grease (Drive End) _____

Pressure _____

Vacuum _____

Any other special accessories with this unit

_____

NOTES: _____

INSTALLATION

WARNING: Customers are cautioned to provide adequate protection, warning and safety equipment necessary to protect personnel against hazards involved in the installation and operation of this equipment in the system or facility.

Do not use air blowers on explosive or hazardous gases. Casing pressure must not exceed 25 PSIG (1.72 bar g). Each size blower has limits on pressure differential, running speed, and discharge temperature, which ***must not*** be exceeded. These limits are shown on the Specification Sheet "Maximum Operating Limits".

LOCATION
Install the blower in a clean, dry, well lighted area if possible. Leave plenty of room around the blower for inspection and maintenance.

FOUNDATION
We recommend a solid foundation be provided for permanent installation. It is necessary that a suitable base be used, such as a steel combination base under blower and motor, or a separate sole plate under each.

Before tightening the bolts, check to see that both mounting feet are resting evenly on the foundation, shim as necessary to eliminate stress on the base when the bolts are tightened.

Where a solid foundation is not feasible, care must be taken to insure that equipment is firmly anchored to adequate structural members.

DRIVE
When the blower is V-belt driven the sheaves must be positioned so that the hub face of the blower sheave is not more than 1/4" (6.5 mm) from the blower drive end plate and the driver sheave is as close to the driver bearing as possible. Care should be taken when installing sheave onto shaft. The faces of the sheaves should be accurately in line to minimize belt wear.

Adjust the belt tension to the belt manufacturer’s specifications.

For installations where the blower is to be operated by direct drive, selection of the driver should be such as not to exceed the maximum speed ratings of the blower. (See Specification Sheet "Maximum Operating Limits.)

A flexible type coupling should be used to connect driver and blower shafts. The two shafts must be aligned within .005" (.13 mm) T.I.R. (Total Indicated Runout)

PROTECTIVE MATERIALS
Remove protective materials from the shaft.

Remove the protective covers from the inlet and outlet ports and inspect the interior for dirt and foreign material.

WARNING: Keep hands, feet, foreign objects and loose clothes from inlet and outlet openings to avoid injury or damage if lobes are to be rotated at this point.

LUBRICATION
Do not start up the blower until you are positive that it has been properly and fully lubricated. (See Lubrication Section.)

PIPING
Inlet and outlet connections on all blowers are large enough to handle maximum volume with minimum friction loss. Maintain same diameter piping. Silencers must not be supported by the blower. Bending moments must be avoided.

Be certain all piping is clean internally before connecting to the blower. We recommend placing a 16-mesh wire screen backed with hardware cloth at or near the inlet connections for the first 50 hours of use until the system is clean. Make provisions to clean the screen after a few hours of operation and completely discard it once the system is clean, as it will eventually deteriorate and small pieces going into the blower can cause serious damage. A horizontal or vertical air flowing piping configuration is easily achieved by rearranging the mounting feet position.

WARNING: Do not operate equipment without adequate silencing devices since high noise level may cause hearing damage. (Reference OSHA Standards.)

RELIEF VALVES
We recommend the use of relief valves to protect against excessive pressure or vacuum conditions. These valves should be tested at initial start-up to be sure they are adjusted to relieve at or below the maximum pressure differential rating of the blower.

CAUTION: Upon completion of the installation, and before applying power, rotate the drive shaft by hand. It must move freely. If it does not, look for uneven mounting, piping strain, excessive belt tension or coupling misalignment or any other cause for binding.

LUBRICATION

The bearings at the drive shaft end of the blower are grease lubricated. The timing gears and bearings at the other end are lubricated by the lower timing gear (when in the horizontal flow configuration) acting as a oil slinger, carrying oil to the upper timing gear and providing splash lubrication for the bearings. Both timing gears act as stingers when the blower is in the vertical flow configuration.

Use a good grade industrial type anti-rust, oxidation and foam inhibited, non-detergent oil.

FILLING PROCEDURE

To fill the gear housing, remove the oil breather* (A) and oil level plug (B) on the gear end. Fill the gear housing until oil drips out of the oil level hole. Replace plugs in their respective holes.

*Models 2002 and 2004 do not have oil breathers. In this case, remove plug to fill.

WARNING: Do not start the blower until you are sure oil has been put in the gear housing.

GREASE LUBRICATED BEARINGS

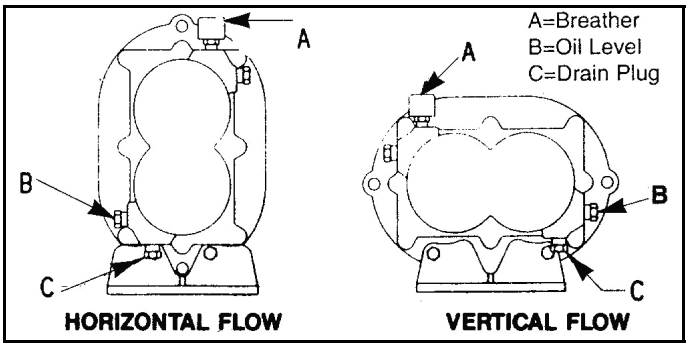
Service drive end bearings at regular intervals. (See "Suggested Lubrication Intervals for Grease Lubricated Bearings" below.) Use NLGI #2 premium grade, petroleum base grease with high temperature resistance and good mechanical stability Using a pressure gun, force new grease into each bearing until traces of clean grease come out of the relief fitting.

CAUTION: To avoid blowing out the drive shaft seal, do not inject grease too rapidly.

LUBRICATION INSTRUCTIONS FOR OIL LUBRICATED GEARS AND BEARINGS

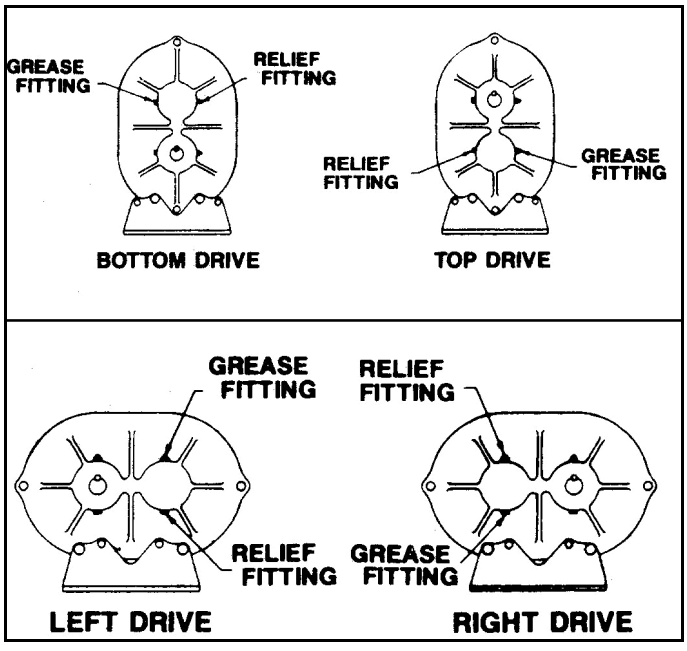
Add fresh oil as required to maintain proper level. Drain and refill after the first 100 hours of operation and thereafter every 1,000 hours of operation under normal service, more frequently depending on the type of oil and oil operating temperature. Use a good quality oil.

AMBIENT TEMPERATURE	OIL GRADE	OIL VISCOSITY RANGE SSU AT 100° F
Above 90° F	SAE 50	1000-1200
32° F to 90° F	SAE 40	700-1000
0° F to 32° F	SAE 30	500-700
Below 0° F	SAE 20	300-500



SUGGESTED LUBRICATION INTERVALS FOR GREASE LUBRICATED BEARINGS

SPEED IN RPM	OPERATING HOURS PER DAY		
	8	16	24
	GREASING INTERVALS IN WEEKS		
750-1000	7	4	2
1000-1500	5	2	1
1500-2000	4	2	1
2000-2500	3	1	1
2500-3000	2	1	1
3000 and up	1	1	1



PREVENTATIVE MAINTENANCE

A good maintenance program will add years of service to your blower.

A newly installed blower should be checked frequently during the first month of operation, especially lubrication. Check oil level in the gear housing and add oil as needed. Complete oil changes are recommended every 1000 operating hours, or more frequently depending on the type of oil and oil operating temperature.

The following is recommended as a minimum maintenance program.

DAILY MAINTENANCE

1. Check and maintain oil level, and add oil as necessary.
2. Check for unusual noise or vibration (See Troubleshooting on page 8).

WEEKLY MAINTENANCE

1. Clean all air filters. A clogged air filter can seriously affect the efficiency of the blower and cause overheating and oil usage.
2. Check relief valve to assure it is operating properly.

MONTHLY MAINTENANCE

1. Inspect the entire system for leaks.
2. Inspect condition of oil and change if necessary (see page 6)

3 Check drive belt tension and tighten if necessary.

START-UP CHECKLIST

We recommend that these startup procedures be followed in sequence and checked (✓) off in the boxes provided in any of the following cases:

- During initial installation
- After any shutdown period
- After maintenance work has been performed
- After blower has been moved to a new location

				Date Checked

				1. Check the unit for proper lubrication. Proper oil level cannot be over-emphasized. Refer to Lubrication Section.
				2. Check Alignment. For Direct Drive: Check coupling and shaft alignment. For Belt Drive: Check for proper belt alignment and tension.
				3. Turn the rotors by hand to be certain they do not bind.

WARNING: Disconnect power. Make certain power is off and locked out before touching any rotating element of the blower, motor or drive components.

				4. "Bump" the unit with the motor a few times to check rotation and to be certain it turns freely and smoothly.
				5. Start the unit and operate it for 30 minutes at no load. During this time. feel the cylinder for hot spots. If minor hot spots occur, refer to the Troubleshooting Section.
				6. Apply the load and observe the operation of the unit for one hour. Check the unit frequently during the first day of operation.
				7. If minor malfunctions occur, discontinue operation and refer to the Troubleshooting Section.

TROUBLESHOOTING

Although **COMPETITOR PLUS**™ blowers are well designed and manufactured, problems may occur due to normal wear and the need for readjustment. The chart below lists symptoms that may occur along with probable causes and remedies.

SYMPTOM	PROBABLE CAUSE	REMEDIES
Loss of oil.	Gear housing not tightened properly.	Tighten gear housing bolts.
	Lip seal failure.	Disassemble and replace lip seal.
	Insufficient sealant.	Remove gear housing and replace sealant. (See Disassembly and Inspection section on page 10)
Excessive bearing or gear wear.	Improper lubrication.	Correct oil level. Replace dirty oil. (See Lubrication section on page 6)
	Excessive belt tension.	Check belt manufacturer's specifications for tension and adjust accordingly.
	Coupling misalignment.	Check carefully, realign if necessary.
Lack of volume.	Slipping belts.	Check belt manufacturer's specifications for tension and adjust accordingly.
	Worn lobe clearances.	Check for proper clearances (See Assembly Clearances on page 14)
	Speed too low.	Increase blower speed within limits.
	Obstruction in piping.	Check system to assure an open flow path.
Knocking.	Unit out of time.	Re-time.
	Distortion due to improper mounting or pipe strains.	Check mounting alignment and relieve pipe strains.
	Excessive pressure differential.	Reduce to manufacturer's recommended pressure. Examine relief valve and reset if necessary.
	Worn gears.	Replace timing gears (See Disassembly and Inspection section on page 10)
Excessive blower temperature.	Too much or too little oil in gear reservoir.	Check oil level. (See Lubrication section on page 6)
	Too low operating speed.	Increase blower speed within limits.
	Clogged filter or silencer.	Remove cause of obstruction.
	Excessive pressure differential.	Reduce pressure differential across the blower.
	Elevated inlet temperature.	Reduce inlet temperature.
	Worn lobe clearances.	Check for proper clearances (See Assembly Clearances on page 14)
Rotor end or tip drag.	Insufficient assembled clearances.	Correct clearances (See Assembly Clearances on page 14)
	Case or frame distortion.	Check mounting and pipe strain.
	Excessive operating pressure.	Reduce pressure differential.
	Excessive operating temperature.	Reduce pressure differential or reduce inlet temperature.
Vibration.	Belt or coupling misalignment.	Check carefully, realign if necessary.
	Lobes rubbing.	Check cylinder for hot spots, then check for lobe contact at these points. Correct clearances (See Assembly Clearances on page 14)
	Worn bearings or gears.	Check condition of gears and bearings; replace if necessary
	Unbalanced or rubbing lobes.	Possible buildup on casing or lobes, or inside lobes. Remove buildup and restore clearances.
	Driver or blower loose.	Check mounting and tighten if necessary.
	Piping resonance.	Check pipe supports, check resonance of nearby equipment, check foundation.

RECOMMENDED SHUTDOWN PROCEDURE TO MINIMIZE RISK OF FREEZING OR CORROSION

When high humidity or moisture is present in an air piping system, condensation of water can occur after the blower is shut down and the blower begins to cool. This creates an environment favorable to corrosion of the iron internal surfaces, or in cold weather, the formation of ice. Either of these conditions can close the operating clearances, causing the blower to fail upon future start-up.

The following shutdown procedure outlined below minimizes the risk of moisture condensation, corrosion and freezing. **Care must be taken so as not to overload or overheat the blower during this procedure.**

1. Isolate the blower from the moist system piping, allowing the blower to intake atmospheric air.Operate the blower under a slight load allowing the blower to heat within safe limits. The heat generated by the blower will quickly evaporate residual moisture.

2. For carpet cleaning applications, after the work is completed, simply allow the blower to run a few (3-5) minutes with the suction hose and wand attached. The suction hose and wand will provide enough load to the blower to evaporate the moisture quickly.

3. For extended shutdown, inject a small amount of a light lubricating oil such as 3-in-One® or a spray lubricant such as WD-40® into the inlet of the blower just prior to shutdown. The lubricant will provide an excellent protective coating on the internal surfaces. If using a spray lubricant, exercise care to prevent the applicator tube from getting sucked into the blower. The applicator tube will damage the blower, most likely to the point that repair would be required.

August 1999

3-in-One and WD-40 are registered trademarks of WD-40 Company.

DISASSEMBLY & INSPECTION

With proper maintenance and lubrication, normal life expectancy for gears, bearings, and seals can be achieved. However, over a period of time these parts must be repaired or replaced to maintain the efficiency of your blower. This section is written in a way that will allow you to completely disassemble your blower. The inspection of certain repairable or replaceable parts is referred to at the point of disassembly where these parts are exposed. If at any point of inspection, repair or replacement is deemed necessary, appropriate instruction will be given to achieve these repair or replacement is deemed necessary, appropriate instruction will be given to achieve these repairs or replacements.

Remove the oil drain plug [18] in the bottom of the gear cover [5] and drain the oil. Take out eight cap screws [16] and remove the gear cover. It may be necessary to tap the sides with a mallet or wooden block to break the seal joint.

Gears are not exposed for visual inspection. Items in brackets [ ] are referenced to item numbers on page 16.

Inspect the gears for the following:

- Broken Teeth
- Chipped Teeth
- Uneven Wear
- Excessive Wear
- Any Other Abnormalities

WARNING: **Before performing any repair or replacement, disconnect and lock out power.**

BLOWER DISASSEMBLY

Position blower with the drive gear on the left when facing the gears. Remove socket head screws and washers. [tems 29 & 26].

Align timing marks and count four (4) teeth down and place reference marks on the gears. (Refer to Figure 1 below)

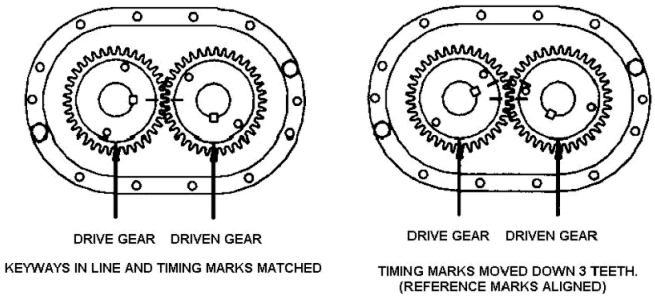

DRIVE GEAR DRIVEN GEAR
KEYWAYS IN LINE AND TIMING MARKS MATCHED
DRIVE GEAR DRIVEN GEAR
TIMING MARKS MOVED DOWN 3 TEETH.
(REFERENCE MARKS ALIGNED)

Figure 1. Timing Gear Alignment

Align reference marks and use puller to pull the driven gear. (Gear on right side). (Refer to Figure 2 below)

Figure 2. Pulling Driven Gear with Jaw Puller

Use puller to remove drive gear. A bar puller (Refer to Figure 3 below) or jack screws can be used.

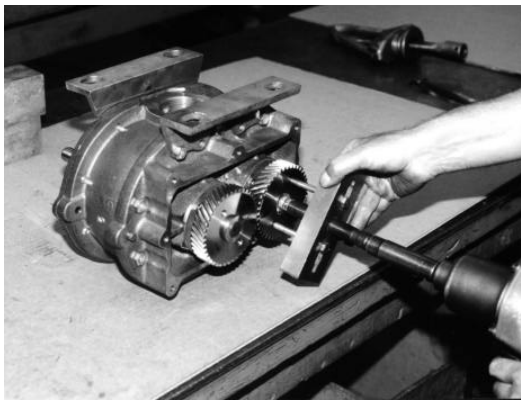


Figure 3. Pulling Drive Gear with Bar Puller

Remove shim and spacer. [Items 28 & 30]

Turn blower around and remove grease cover [Item 10]

Remove eight (8) cap screws. [Item 15]

Use jackscrews to remove end plate. (Refer to Figure 4 below)

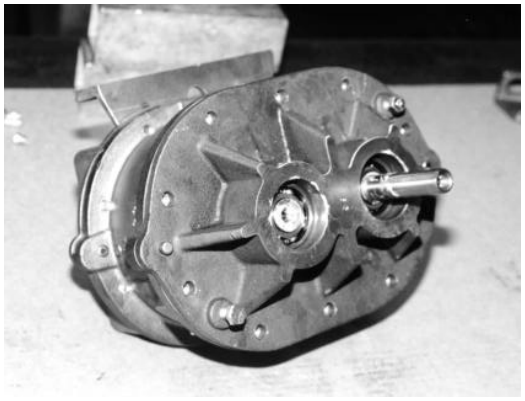


Figure 4. Pulling Drive End Plate

Press rotors out of end plate in press if available. If press is not available, support end plate and rotors in the housing. Block up housing and use a soft mallet to drive the rotors out. (Refer to Figure 5 below)

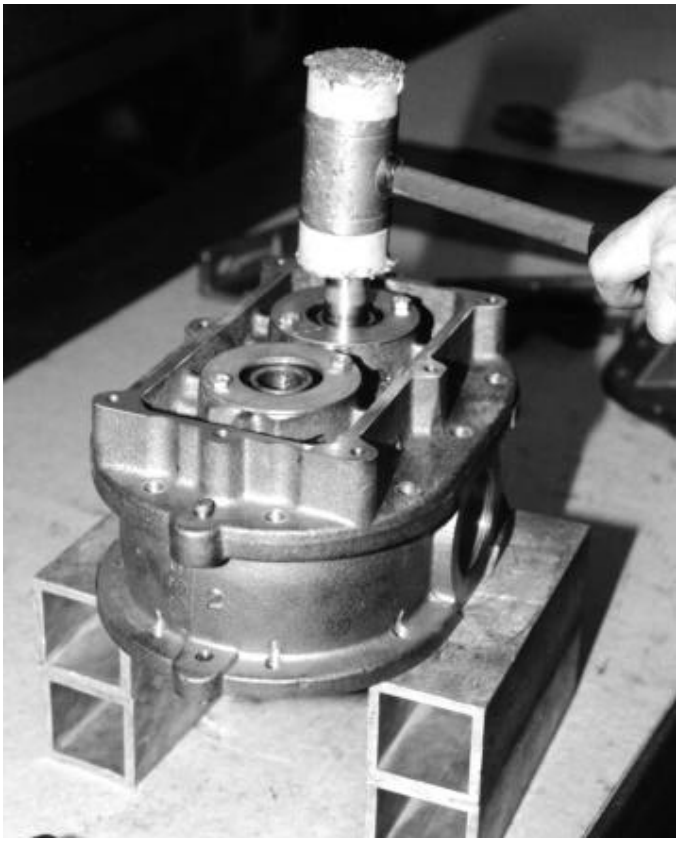


Figure 5. Driving Rotors Out Using Soft Mallet

A jaw type puller can also be used. (Refer to Figure 6 below)

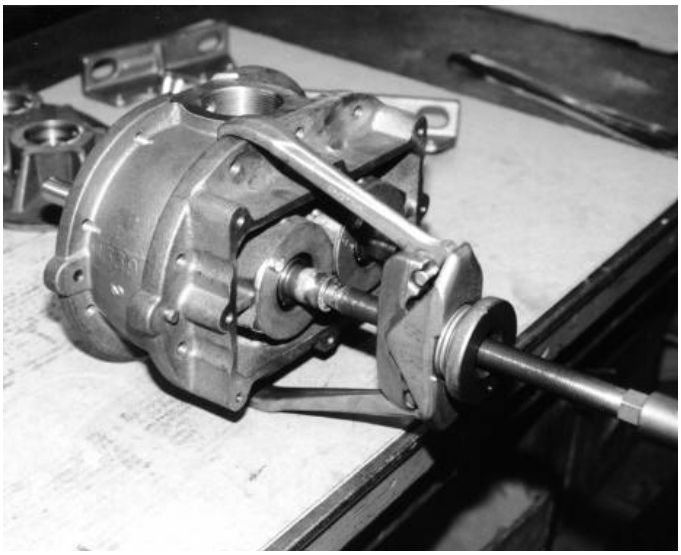


Figure 6. Driving Rotors Out Using Jaw Puller

Using a tube or round bar of a slightly smaller diameter than the shaft clearance holes in the end plates, tap the bearings out of the end plates. Bearing retainers [Item 22] must be removed before knocking out the bearings. (Refer to Figure 7 below)

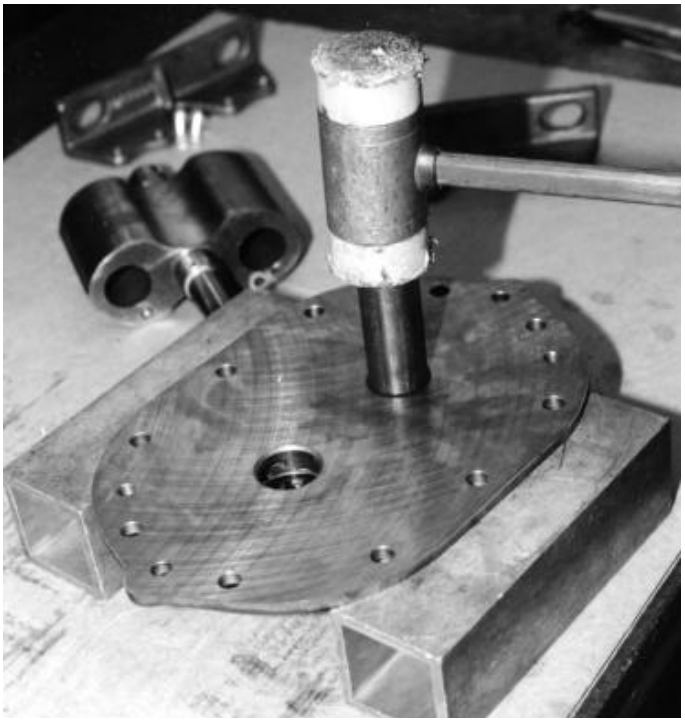


Figure 7. Tapping Bearings Out of End Plates

Remove seals from both end plates with a punch or dull chisel. The seals ***will*** be damaged during removal and must be replaced.

Inspect all parts for wear and or damage.

Clean and inspect all parts for burrs and polish seal journals with at least 320 grit emery or crocus cloth.

Items in brackets [ ] are referenced to item numbers on page 16.

BLOWER ASSEMBLY

After thorough cleaning of the seal and bearing bores of both end plates apply a thin coat of sealant on the outside diameter of the new seals and press them into the end plate using a tool that will bear on the outer edge of the seal. Spring side of the seal should be facing you. Apply a thin coat of grease to the seal lip.

Using the drive end plate as a fixture, support it high enough so the input shaft of the drive rotor clears the assembly surface. (Refer to Figure A1 below). Place rotors in fixture with the drive rotor to the left. (See Figures A1 and A2 below)

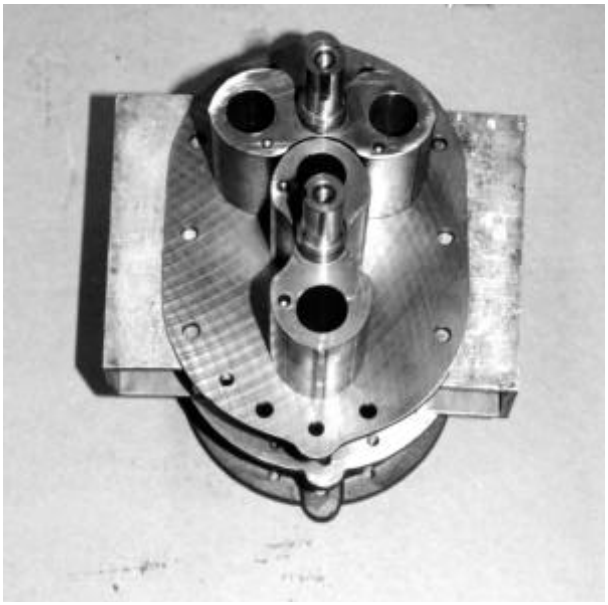


Figure A1. Rotors Assembled on Drive End Plate

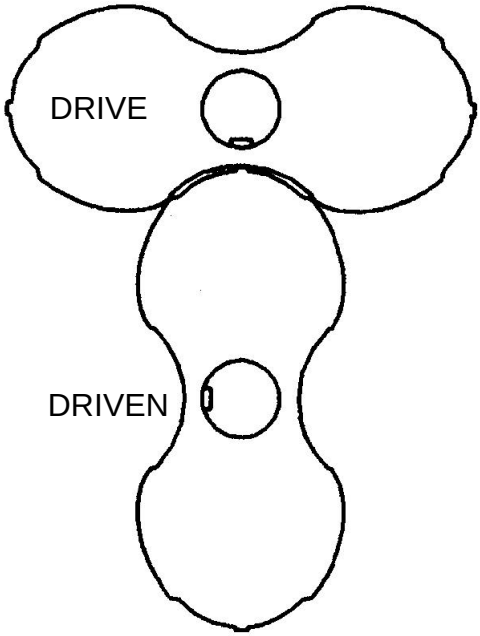


Figure A2. Detail of Proper Keyway Positions
(**NOTE:** Keyway positions are exactly opposite for models 6005, 6008 and 6015)

Place end plate [Item 4] on rotors.

Apply a thin coat of lubricant on the rotor shafts and the inner race of the bearings. Tap the bearings [13] into place using a tube with a flanged end that will contact both the inner and outer bearing races. (Refer to Figure A3 below).

Figure A3. Tapping Bearings into End Plates

Rotor alignment will be opposite that of Figure A2 on all 6" units (keyway on drive rotor will be up and driven to the right).

WARNING: Keep hands and loose clothing away from lobes and gears.

Install bearing retainers [Items 22 & 25] to both bearings.

Check clearances between the end of the rotors and the face of the end plate. Refer to assembly clearances chart on page 14 for proper clearances for your model blower, and refer to page 13 for procedures for checking and adjusting clearances.

If clearances check OK, put a spacer [28] and a shim [30] on each shaft. Timing shims that were removed should be put back on the shaft from which they were removed.

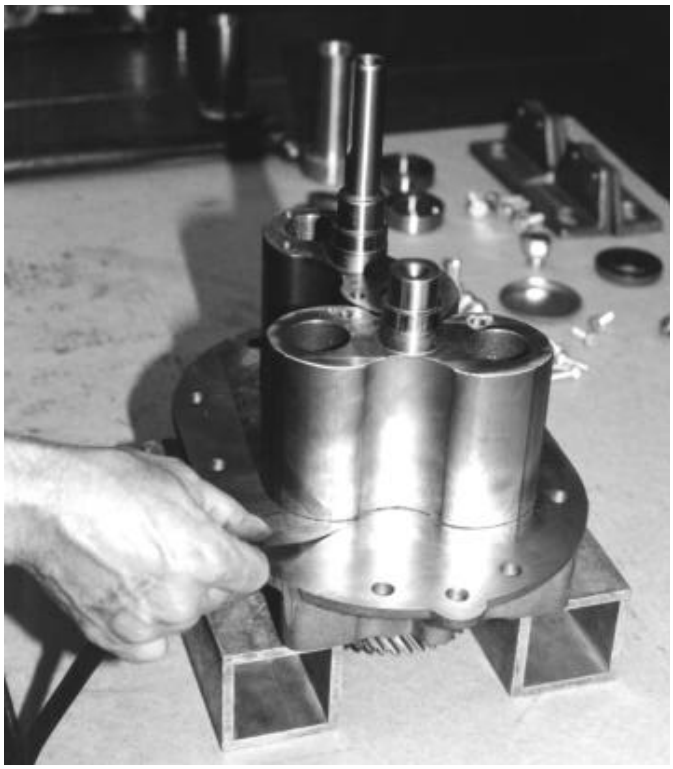


Figure A4. Checking Gear End Clearances

Lubricate shafts and bores on gears. Begin by pressing on the DRIVE gear. This will be pressed on the drive rotor, which is to the left.

Start the driver gear on the shaft and align the reference timing marks and press gear on. Lock gears in place with cap screw [29] and washer [26]. Turn assembly over and rest the unit on the cap screws and washers on the gear end.

Set dowel pins [9] in housing and position housing over the rotors and fasten with cap screws [15]. Check housing to rotor clearance. (Refer to Figure A5) A depth mic can be used.

Set on drive end plate [3] and fasten with cap screws [15]. (**ATTENTION:** There are four cap screws [17] which are used to fasten the feet on.) Lubricate shafts and bearings. Install the ball bearing [12] on the driven rotor and the roller bearing [11] on the input shaft.

Install grease cover [Item 10] and drive shaft seal [23].

Install any removed plugs [18] and replace breather [27] if required.

Items in brackets [ ] are referenced to item numbers on page 16.

ADJUSTING ROTOR INTERLOBE CLEARANCE

Using feeler gauges take interlobe readings and record on each side of housing as indicated in Figure A5 below. By removing or adding shim behind the helical gear, it rotates as it is moved in or out and the driven rotor turns with it, thus changing the clearance between rotor lobes.

Changing the shim thickness .006" (.15 mm) will change the rotor lobe clearance .003" (.08 mm) or one-half the amount.

EXAMPLE: Referring to Figure A5 below, check the clearance at AA (right hand reading) and BB (left hand reading). If AA reading is .009" (.23 mm) and BB reading .003" (.08 mm) by removing .006" (.15 mm) shims. the readings will change one half the amount removed or .003" (.08 mm). AA should then read .006" (.15 mm) and BB should read .006" (.15 mm). The final reading should be within .002" (.05 mm) of each other.

To determine the amount of shim to add or remove, subtract the small figure from the larger. If the right side is higher than the left side, remove shim. If the right side is reading lower, add shim.

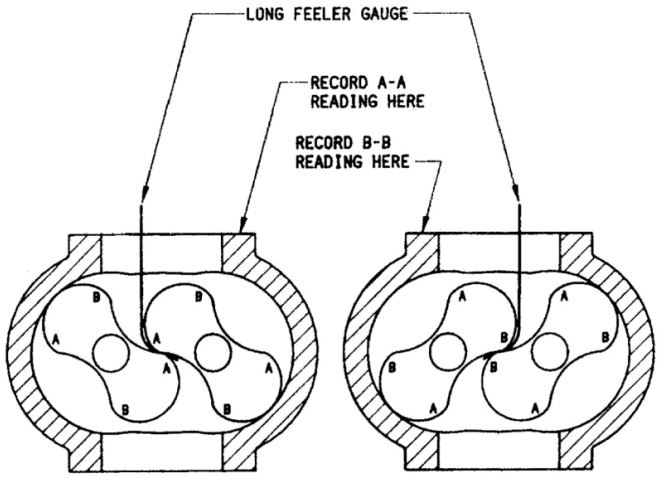


Figure A5. Checking Gear End Clearances

LUBRICATION, FINAL ASSEMBLY AND MOUNTING

Pack the bearing cavities with suitable grease. Install bearing cover plate [10]. Replace front lip seal [23] taking care not to damage the lip as it passes over the keyway. Lip must point inward toward the bearing. Apply a good quality RTV silicone sealant to the inner surface of the gear cover [5]. Install the gear cover with cap screws [16] and tighten evenly.

Fill gear cover with oil and grease front-end bearings. Refer to the Lubrication Section in this manual for oil and grease specification and filling procedures.

To insure blower has not been distorted during mounting in the installation, turn the lobes by hand to make sure they are not making contact prior to connecting to the driver.

COMPETITOR+ PLUS™

MAINTENANCE AND SERVICE SPECIFICATIONS SHEET

ASSEMBLY CLEARANCES

Metric values (mm) are shown in parentheses ( )
All other values are in inches

MODEL	LOBES TO END PLATES			LOBE TO CASING		INTERLOBE
	TOTAL (MIN./MAX.)	DRIVE END (MINIMUM)	GEAR END (MINIMUM)	MINIMUM	MAXIMUM	MININUM
2002, 2004	.005" / .010" (.13 / .25)	.003" (.08)	.002" (.05)	.004" (.10)	.008" (.20)	.006" (.15)
3003, 3006	.005" / .010" (.13 / .25)	.003" (.08)	.002" (.05)	.004" (.10)	.008" (.20)	.008" (.20)
4002, 4005,4007	.007" / .012" (.18 / .30)	.004" (.10)	.003" (.08)	.005" (.13)	.009" (.23)	.010" (.25)
5003, 5006, 5009	.007" / .012" (.18 / .30)	.004" (.10)	.003" (.08)	.005" (.13)	.009" (.23)	.012" (.30)
6005, 6008, 6015	.011" / .015" (.28 / .38)	.008" (.20)	.003" (.08)	.006" (.15)	.010" (.25)	.010" (.25)

OIL RESERVOIR CAPACITIES

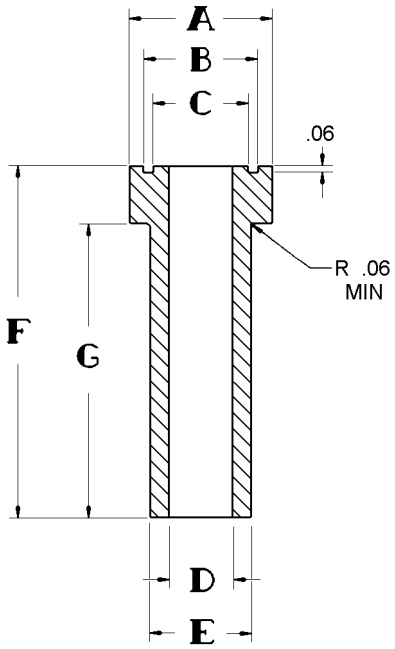
MODEL	FLUID OUNCES (LITERS)	
	HORIZONTAL FLOW	VERTICAL FLOW
2002, 2004	3.5 (.10)	6.0 (.18)
3003, 3006	6.0 (.18)	16.0 (.47)
4002, 4005, 4007	7.0 (.21)	22.8 (.67)
5003, 5006, 5009	16.0 (.47)	27.6 (.82)
6005, 6008, 6015	28.0 (.83)	52.0 (1.54)

MAXIMUM OPERATING LIMITS

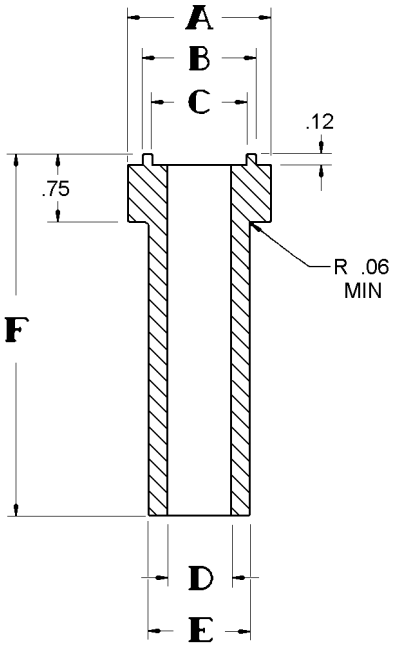
MODEL	RPM	PRESSURE PSI (mbar)	VACUUM in. Hg (mbar)	TEMPERATURE RISE F^o (C^o)
2002	5275	12 (825)	14 (475)	225 (125)
2004	5275	7 (480)	14 (475)	185 (103)
3003	3600	12 (825)	14 (475)	170 (94)
3006	3600	7 (480)	14 (475)	115 (64)
4002	3600	15 (1035)	14 (475)	240 (133)
4005	3600	10 (690)	14 (475)	170 (94)
4007	3600	7 (480)	14 (475)	130 (72)
5003	2850	15 (1035)	14 (475)	195 (108)
5006	2850	10 (690)	14 (475)	180 (100)
5009	2850	7 (480)	14 (475)	115 (64)
6005	2350	15 (1035)	16 (540)	250 (139)
6008	2350	12 (827)	16 (540)	240 (133)
6015	2350	6 (415)	12 (410)	130 (72)

SPECIAL TOOL DRAWINGS

All dimensions shown are in inches.



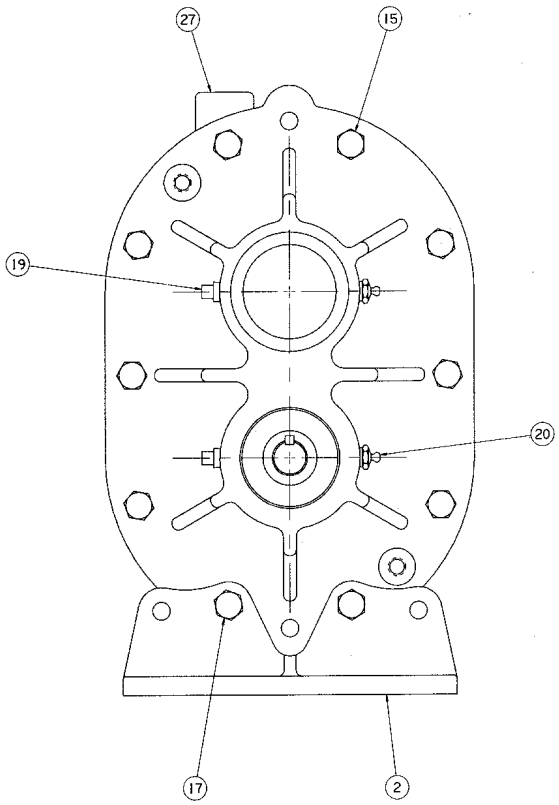
MODEL	PART NUMBER	A	B	C	D	E	F	G
2000	2200718B	1.560± .001	1.27± .005	.98± .005	.70± .005	1.10± .005	3.50± .005	3.00± .005
3000	3300718B	2.035± .001	1.70± .005	1.335± .005	1.015± .005	1.415± .005	3.75± .005	3.00± .005
4000	4200718B	2.425± .001	2.02± .005	1.61± .005	1.21± .005	1.61± .005	4.50± .005	3.75± .005
5000	5300718B	2.820± .001	2.42± .005	1.81± .005	1.41± .005	1.81± .005	5.00± .005	4.25± .005
6000	6500718B	3.135± .001	2.73± .005	2.00± .005	1.605± .005	2.00± .005	6.25± .005	5.50± .005

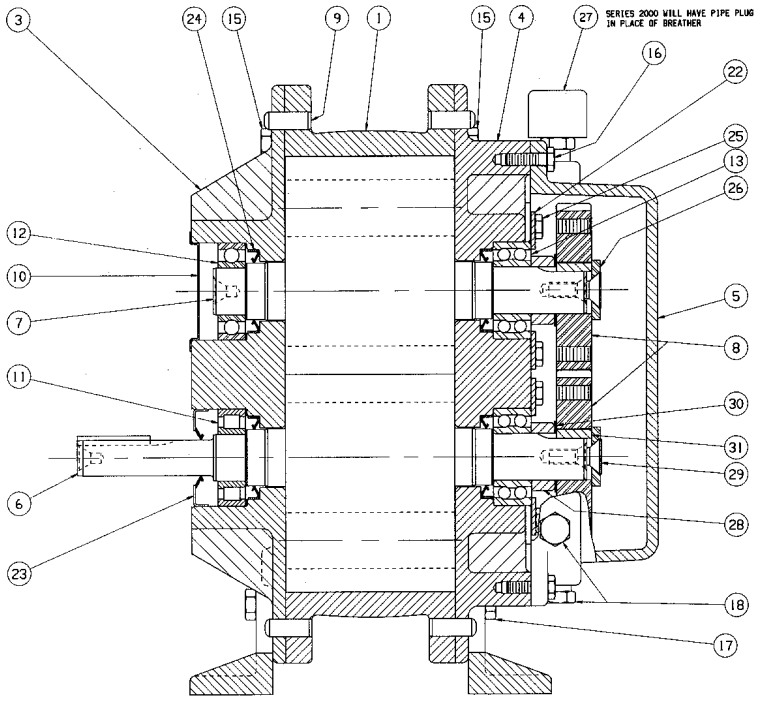


MODEL	PART NUMBER	A	B	C	D	E	F
2000	2200708B	1.560± .001	1.24± .005	1.04± .005	.70± .005	1.10± .005	4.00± .005
3000	3300708B	2.035± .001	1.74± .005	1.54± .005	1.015± .005	1.415± .005	4.37± .005
4000	4200708B	2.425± .001	1.865± .005	1.665± .005	1.21± .005	1.61± .005	5.25± .005
5000	5300708B	2.820± .001	2.427± .005	2.227± .005	1.41± .005	1.81± .005	5.68± .005
6000	6500708B	3.135± .001	2.74± .005	2.54± .005	1.605± .005	2.00± .005	7.00± .005

COMPETITOR+ PLUS™

CUTAWAY VIEW AND PARTS LIST





ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Housing	1	15	Screw, Hex Head	16
2	Mounting Foot	2 *	16	Screw, Hex Head	8 **
3	Drive End Plate	1	17	Screw, Hex Head	4
4	Gear End Plate	1	18	Plug, Oil	3
5	Gear Cover	1	19	Relief Fitting	2
6	Drive Rotor	1	20	Grease Fitting	2
7	Driven Rotor	1	22	Bearing Retainer	4
8	Timing Gear	2	23	Lip Seal, Drive Shaft	1
9	Dowel Pin	4	24	Lip Seal	4
10	Bearing Cover Plate	1	25	Screw, Hex Head	4
11	Roller Bearing, Drive Shaft	1	26	Washer	2
12	Bearing	1	27	Breather †	1
13	Bearing	2			

* Item 2: Models 6005, 6008 and 6015 require (2) each of left and right feet.
** Item 16: Models 5003, 5006 and 5009 require (6) each.
† Item 27: Models 2002 and 2004 requires a pipe plug in lieu of breather.

When ordering parts, use the item number shown, plus your model and serial number.

WARRANTY

Subject to the terms and conditions hereinafter set forth and set forth in General Terms of Sale, Tuthill Pneumatics Group (the seller) warrants products and parts of its manufacture, when shipped, and its work (including installation and start-up) when performed, will be of good quality and will be free from defects in material and workmanship. This warranty applies only to Seller's equipment, under use and service in accordance with seller's written instructions, recommendations and ratings for installation, operating, maintenance and service of products, for a period as stated in the table below. Because of varying conditions of installation and operation, all guarantees of performance are subject to plus or minus 5% variation. (Non-standard materials are subject to a plus or minus 10% variation)

Product Type	**Type of Application**	
	Atmospheric Air or Process Air Without Liquids Present	**Process Gases Other Than Air, or Any Liquid Injected Application**
New	24 months from date of shipment, or 18 months after initial startup date, whichever occurs first	18 months from date of shipment, or 12 months after initial startup date, whichever occurs first
Repair	3 months from date of shipment, or remaining warranty period, whichever is greater	3 months from date of shipment, or remaining warranty period, whichever is greater

THIS WARRANTY EXTENDS ONLY TO BUYER AND/OR ORIGINAL END USER, AND IN NO EVENT SHALL THE SELLER BE LIABLE FOR PROPERTY DAMAGE SUSTAINED BY A PERSON DESIGNATED BY THE LAW OF ANY JURISDICTION AS A THIRD PARTY BENEFICIARY OF THIS WARRANTY OR ANY OTHER WARRANTY HELD TO SURVIVE SELLER'S DISCLAIMER.

All accessories furnished by Seller but manufactured by others bear only that manufacturer's standard warranty.

All claims for defective products, parts, or work under this warranty must be made in writing immediately upon discovery and, in any event within one (1) year from date of shipment of the applicable item and all claims for defective work must be made in writing immediately upon discovery and in any event within one (1) year from date of completion thereof by Seller. Unless done with prior written consent of Seller, any repairs, alterations or disassembly of Seller's equipment shall void warranty. Installation and transportation costs are not included and defective items must be held for Seller's inspection and returned to Seller's Ex-works point upon request.

THERE ARE NO WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS OF PURPOSE.

After Buyer's submission of a claim as provided above and its approval, Seller shall at its option either repair or replace its product, part, or work at the original Ex-works point of shipment, or refund an equitable portion of the purchase price.

The products and parts sold hereunder are not warranted for operation with erosive or corrosive material or those which may lead to build up of material within the product supplied, nor those which are incompatible with the materials of construction. The Buyer shall have no claim whatsoever and no product or part shall be deemed to be defective by reason of failure to resist erosive or corrosive action nor for problems resulting from build-up of material within the unit nor for problems due to incompatibility with the materials of construction.

Any improper use, operation beyond capacity, substitution of parts not approved by Seller, or any alteration or repair by others in such manner as in Seller's judgment affects the product materially and adversely shall void this warranty.

No employee or representative of Seller other than an Officer of the Company is authorized to change this warranty in any way or grant any other warranty. Any such change by an Officer of the Company must be in writing.

The foregoing is Seller's only obligation and Buyer's only remedy for breach of warranty, and except for gross negligence, willful misconduct and remedies permitted under the General Terms of Sale in the sections on **CONTRACT PERFORMANCE, INSPECTION AND ACCEPTANCE** and the **PATENTS** Clause hereof, the foregoing is **BUYER'S ONLY REMEDY HEREUNDER BY WAY OF BREACH OF CONTRACT, TORT OR OTHERWISE, WITHOUT REGARD TO WHETHER ANY DEFECT WAS DISCOVERED OR LATENT AT THE TIME OF DELIVERY OF THE PRODUCT OR WORK.** In no event shall Buyer be entitled to incidental or consequential damages. Any action for breach of this agreement must commence within one (1) year after the cause of action has occurred.

January, 2001

NOTES